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Science and Art Gossip.

WE hear with extreme regret of the death of Dr. Henry Draper, Professor of Physiology at the University of New York. It has followed very soon after the death of his father. In Dr. H. Draper science loses an honest and zealous worker; one who has devoted time without promise of reward to his scientific work, nay, has expended more money in his free gift of labour to science than some advocates of the Endowment of Research have begged for. The discovery that oxygen, and probably nitrogen, exist in the atmosphere of the sun, is due to Dr. Draper, and would of itself suffice to keep his memory green. Scarcely less important, however, was his success in photographing the spectra of stars and planets, of Wells's Comet, and the great Orion nebula. The zeal and devotion with which he discussed the photographic methods available for observing the transit of Venus in 1874 were fully recognised by his fellow-workers in science, and even, wonderful to relate, by the Government.

THE Poet Laureate seems to find it difficult to believe he is not a dramatist. Perhaps this is because some unwise critics described his first play as equal, *at least*, to Shakespeare's "Henry VIII." (so much of that play as may be Shakespeare's). "Queen Mary," where every character comes in with his label, saying at the outset in effect, "I am a clever person," or "Here you have a hypocrite," or "Behold in me the chief villain," should have shown every one of any critical judgment that our deservedly eminent poet has no dramatic power whatever. From bad to worse and worst, has brought us the "Promise of May," where the poet's idea of what a freethinker ought to be (but what no freethinker ever was or will be) is brought out in company with an utterly impossible plot, the climax of the unnatural being reached when a wretched girl, who returns to ask for pardon from her father, seems to jest (though the poet, no doubt, meant otherwise) at the words which show his mind is wandering:—"Take me out, little maid," he says, "this is one of my bad days:" there is a touch of true pathos here, though rather poetic than dramatic,—and she says, as he retires, "This is like to be the *last* of *my* bad days."

THE Postmaster-General, in reply to a question in the House of Commons on the 9th inst., said that, taking a radius of one mile from the Post-office, the proportion, of underground to overhead telegraph wires was 1,822 miles underground, as compared with 58 miles overhead. By far the greater number of overhead wires belonged to telephone and other companies, and not to the Post-office. In one thoroughfare there were 97 overhead wires, only three of which belonged to the Post-office.

AMONG the proofs of the development of civilised races from savage tribes are the fighting instincts, which the reason rejects as unworthy, but which most of us feel none the less. We suspect even Mr. Herbert Spencer, who speaks with such contempt of these instincts, if he once began a fight, would hold out while he could see or stand. Many who hold (as we do) that all save defensive wars degrade the nation that begins them, have in them fighting instincts altogether independent of any question of right or wrong; instincts that once roused transform the whole nature, or rather show our nature as we had not before known it. So, too, "the pomp and circumstance of glorious war," which reason holds in supreme contempt, affect the calmest and the wisest. The fact is we are none of us so wise as we think in these matters. "We must pay soldiers to defend us," said a "white-bearded fellow" at the march past last Saturday; "but it is not a noble employment," *und so weiter*. A little later the band struck up, the martial pageant began, and lo! our wise man was cheering with the loudest. And why not? If we must (and we *must*) have fighting, those who do it for us deserve our heartiest thanks, even though they are paid so many pence a day for the work. And though military pomp no longer moves the more reasoning among us, one does not much envy the man who can see a torn war-stained flag, and, thinking what those rags and tatters *mean*, feels no thrill as it is borne past him.

A CORRESPONDENT who approves of our objections to the publication of a private letter by Darwin's correspondent, expresses further the opinion that while Darwin's views about matters scientific must necessarily be of weight, his views about religious matters cannot be equal in value to those of men who have given their whole life to the study of revelation. We doubt if this would apply to his opinion whether there *has* been a revelation. By parity of reasoning the opinion of a Christian theologian should be regarded as of no weight against the views of a learned Buddhist respecting the validity of what *he* held to be revelation. All that any theologian can do is to acquire intimate and perfect knowledge of what those books teach which are sacred to *him*. Against the whole life of a Christian, Mahommedan, or Buddhist theologian devoted to the study of what he regards as a revelation (and two out of the three *must* be mistaken), may very fairly be set the whole life of another man devoted to study on a line consistent, perhaps he may have thought with only a material revelation.

AFTER a heavy storm of wind and rain, which terminated yesterday week, there was experienced the most severe "magnetic storm" ever recorded. It commenced early last Friday morning, and continued at irregular intervals until Monday. The aurora was distinctly visible, and earth-currents traversed the telegraph wires throughout the country. The currents varied considerably in strength and alternated in direction very rapidly, although the

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general direction appears to have been south-west to north-east. At one time the current measured 59 milliampères, and as most of the telegraphic apparatus now employed responds to a current of 3·3 milliampères, the effect can be readily imagined. "Looping" was resorted to in almost every possible instance (by looping is meant dispensing with earth-connections and using a return wire instead.) This method, while it prevents earth-currents reaching the wires, necessarily reduces the number of lines by half, besides doubling the resistance of the circuit in each case.

THE value of the American signal service to the commerce of the country was strikingly illustrated during the violent equinoctial storm in September. As soon as its approach was heralded from the South Atlantic coast, cautionary signals were displayed at all the ports, and hundreds of vessels, whose commanders had learned by experience the value of such warnings, waited in harbour until the storm was over. The observers at a number of ports report that the value of the vessels and their cargoes which were prevented from sailing by these signals was $6,460,586, and as no trustworthy statistics could be obtained from New York, Philadelphia, or Boston, the estimate that $13,000,000 of property in all was thus kept safely in harbour does not appear unreasonable. As the storm was very severe, there is no doubt that a considerable percentage of this great sum, to say nothing of many lives, would have been lost if the vessels had put to sea, and the saving thus effected is of itself a sufficient vindication of the value and efficiency of the signal service.

OVER-HEAD WIRES AGAIN.—The daily papers report a fire in a Manchester warehouse last Friday, with a loss of £100,000. It is asserted that fully 300 telegraph and telephone wires converged on or passed over the building. They were in the midst of the flames. "A few of the wires broke soon after the fire had heated them, and fell into the street, but the main portion held out until the roof of the warehouse gave way, and they were then broken by hundreds, and the ends of most of them fell in a state of white heat into the street or on the roofs of adjoining buildings." We leave our readers to imagine the amount and duration of the inconvenience likely to result from such a catastrophe.

IN the *Evening Times* some capital star maps have been commenced, which promise to be of great use in spreading a knowledge of the heavens. It is worthy of notice that these maps are printed with the ordinary machinery of the *Evening Times*, which prints 25,000 impressions in an hour.

THE following statistics may interest those readers (very few) who seem to think Sir J. Hooker may after all be using the public fairly in the matter of Kew Gardens :—

These Gardens cost the public upwards of £20,000 per annum, and are open from one o'clock to sunset, at this time of the year averaging about three hours daily. Edinburgh Botanic Garden, costing (in 1877) £1,400 a year, opened from 6 a.m. to 6 p.m. in summer, daylight to dusk in winter, and from 6 a.m. to 8 p.m. in June, July, and August. Lectures and classes are held daily. (Extracts from report, 1876.—"For the bare support of the Garden £200 more of annual income is required." The funds at present granted for the ordinary expenditure of the Garden are only £1,400, a sum very inadequate, and it is only by the utmost economy that the wages of the men can be paid." "The class last session consisted of sixty-six pupils, and the room can only accommodate thirty," &c.) Dublin Botanic Garden is open from 10 a.m. to 6 p.m. Madrid Jardin Botánico is open from morning until dusk. Christiania Botanical Gardens are open all day long. Hamburg Botanical Gardens are open from sunrise to sunset. Geneva Jardin Botanique and Jardin Anglais, open from sunrise to 10 p.m. Amsterdam "Hortus Botanicus" of the University, open from sunrise to sunset.

A RATHER amusing mistake was made in our Gossip columns last week; a mistake for which our readers have not, we think, to thank ourselves, but the printers. We meant, at any rate, to say that Elihu was spoken of as approved of Yahveh (or Jehovah); but he is described as "approving of Yahveh," which would rather have suited the three friends Bildad, Eliphaz, and Zophar, and some teachers even in our own times. I recall here a case showing rather amusingly that many of the more ranting religionists are very ignorant of the book they intend to revere. At the close of a lecture in Sydney we had quoted as a sentiment, of which every student of science still sees the truth, the saying of Elihu that as touching the Almighty we cannot find Him out. On this it was announced the next Sunday by a popular preacher that he would show the foolishness in God's eyes of "Job's three friends and Mr. Proctor," who failed to find out God. It was a new light to him that Elihu was not one of the three friends of Job, but condemned them as fully and as justly as he reproved Job.

As a proof of the advantage of using the type-writer, I note that, owing doubtless to our bad writing, the Rosse telescope has been magnified from a real diameter of six feet to one of eight feet. We usually answer correspondents on the type-writer, but this time were away on a lecturing tour.

A MEETING was held in the Royal Exchange, Middlesbrough, on Friday, the 10th inst., to consider the proposal of Mr. B. Samuelson, M.P., to establish a school of science at Middlesbrough. A letter from Mr. Samuelson was read, giving his views on the matter. He suggests, first, that the school should give theoretical and practical instruction in inorganic chemistry and in certain departments of physics, more especially heat. Secondly, that there should also be taught elementary mathematics, including mechanics and drawing. Thirdly, that the earlier courses should be followed by others in metallurgy, more particularly in the technology of iron and steel. Fourthly, that organic chemistry should be taught, and pupils should be instructed in the technology of the chemical manufactures in the district. Mr. Samuelson thinks the school could be built for £5,000, exclusive of land, and recommends that not less than £10,000 should be raised. He says he is willing to subscribe £2,000 and £120 per annum. A committee was appointed to take the matter up.

THE star maps for November and December are to be published, price 2d. each, for the benefit of those who wish to complete sets.

THE editor requests that in future letters intended for the authors of articles in KNOWLEDGE, should be addressed to them, care of the publishers, as it has become quite impossible for him to deal with half the letters which reach him. In any case, there can be no quick replies to most letters, for already there are dozens in arrear. If any reader can suggest a way out of the difficulty, short of random shots at the waste paper-basket, he will oblige; but not if he has no practical suggestion to make, for that would only add to the difficulty.

THE GREAT COMET.

By T. W. Webb.

I HAD been hitherto very unfortunate with respect to this noble object. Presuming, after what I had read on the subject, that with so efficient an instrument as my excellent 9½-inch "With" mirror I should have little difficulty in detecting the nucleus by day, and being anxious to ascertain its aspect, as to which no definite information had up to that time reached me, I spent much time on September 22, and again on October 2, in sweeping for it, but all in vain; my very hot and uncomfortable search on the former day being enlivened by the occasional passage of small white nebulosities across the field, which I at once recognised, according to Dawes's former experience, as thistle-down or winged seeds of some kind. One of these for a second or two revived my hope as to the attainment of my object, being, no doubt, entangled in some temporary aerial eddy, from which it soon escaped and sailed away speedily after its congeners. October 3, in the early morning, I obtained my first view of the end of the tail, the rest being hidden by trees. It was of a distinct though very pale brownish yellow hue. From that time bad weather or other hindrances prevented my getting a sight of it till after I had left home, October 25, when, as on the following morning, notwithstanding a full moon, it was a conspicuous object. The nucleus appeared in a small binocular like a third magnitude star, with a coma of perhaps 15′ in diameter; the tail, to the naked eye, may have reached about 15°, of a slightly yellowish tinge, of considerable apparent density, not much degraded towards the end where it was a good deal expanded, curving very slightly upwards, and rather better defined on the under side. On the 25th my wife's keen sight detected a darker space in the interior of the tail, for a considerable distance from the end, which was bifurcated, the uppermost apparent portion being the longer and the most curved upwards, presenting a slight resemblance to some of Schröter's figures of the comet of 1807, in which, however, this unequal division was so strongly marked as to lead that observer to the idea of a double, not hollow, tail. The approaching though decreasing moon subsequently interfered with its visibility, but on Oct. 9, that impediment being removed, it was a very striking object about 5 h., and not inferior to its earlier appearance. Bad weather again intervened till Nov. 14, when, as there was a fair prospect over-night, I left the shutters of the telescope-house open, and the ocular (a beautiful low-power Kellner, by Parkes, of Birmingham) in its place, and everything prepared for an attempt before the dawn. Nov. 15, at 3 h. 30 m., the end of the tail was visible in the south, and before 5 h. the whole comet was a striking object from the house; and though we both thought that it was a hopeless case, as being below the range of the "great gun," yet I decided on a hasty dressing, and sallied out, in a temperature of 25°, to be fully repaid for my venture. Though shortly about to pass behind trees, the head was completely visible, and the sharpness of the surrounding stars proved that its definition suffered little from its small altitude. But great was my astonishment to find that the nucleus, which had just before been seen with the binocular as a misty third magnitude star, was entirely dissolved into haze. It was very considerably elongated, at least three times longer than broad, by an independent estimate, agreeing remarkably with that of Dr. Erck, on Oct. 16; and though eminently luminous, entirely destitute of definite outline, melting away into the surrounding feeble coma, and forming the uninterrupted base of a dense tail. These appearances were fully confirmed by a very fine positive ocular, power about 200. A rough guess from memory might allow it about 0′·75 by at least 3′. Its aspect was that of a brilliant and abrupt condensation of the surrounding mist, without the slightest indication of jet or envelope or more luminous centre. I did not on this occasion notice the harder definition of the lower side of the tail, but we both remarked a kind of tuft at the end of the upper side, as though some of the luminous material were left behind and scattered in its progress. The subsequent change of weather has made me still more pleased with my success; as possibly this may have been the last opportunity of efficient observation, before increasing distance has rendered it a more difficult and less interesting object.

In a neighbourhood so remote from the ordinary opportunities of scientific observation, I have perhaps no right to complain; but I have been much struck with the absence of easily-accessible information as to the aspect of the head of the comet in its earlier stages. We have heard much of its having been seen, but little of what it was like. Even in that "unique" observation which records its visibility even up to the sun's limb, no mention was made, as far as I have seen, of its aspect or apparent magnitude. Let me express the hope that, at some future time, when its visible course has been more nearly run, and suitable materials can be collected, our Editor will favour [us with what he is so peculiarly qualified to give [thanks, but I doubt this much.—R. A. P.]—an exhaustive monograph of this confessedly most wonderful object; and if it should swell to the magnitude of a treatise, I am sure none of his readers will complain.

THE REVIEW.

By the Editor.

BY the merest accident, I saw much more of the march of the troops, &c., last Saturday—having been trapped in St. James's Park by a clever manœuvre of the park-keepers, on my way from St. James's-station to Piccadilly—than I wanted to see. Let me record something of what I saw and of what I thought on the occasion. It had its sociological, and therefore its scientific aspect. The people have had an opportunity of expressing their sense of the business-like way in which a difficult and trying campaign has been carried out, and their recognition of the bravery which our troops displayed, as far as the cowardice and inefficiency of the troops opposed to them would permit. There was something very satisfactory in the sensible way in which those assembled to witness the march of the troops welcomed those who had done their work well, and who would certainly have shown the old fighting qualities of our well-welded race if they had had the chance. There was a kindly warmth about the reception of the soldiers, no very undue air of glorification over a small triumph, and good temper with the rather blundering police. The soldiery looked as if they had no end of fighting in them, if wanted—not so stalwart, all of them, as we could have wished, but with looks suggestive of stubborn pluck, such as the British bull-dog is expected to possess, and as (Herbert Spencer notes) the Tasmanian Devil possesses in higher degree than any animal on the face of the earth. Many of the officers rode ill, but perhaps their horses suffered in Egypt. The police were good-tempered, and though some of them acted rather stupidly, they stood the chaff of the people pleasantly enough. The way in which they imprisoned many hundreds of British citizens in St. James's Park was ingeniously blundering,

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for they locked the gates on the north side at the same time as those on the south, when a little common sense would have told them that ingress should in such cases be always stopped before egress is prevented. Thus, many who had intended to see the march from their club windows, or had even paid for windows along Piccadilly, St. James's-street, and so forth, and (a more serious wrong) several working men on their way to execute orders, found themselves imprisoned in St. James's-park at half-past eleven, through a piece of sheer stupidity on the part of the park-keepers and police. Viewing the conduct of these prisoners as a student of character, I was struck by their patience while they thought their imprisonment due to official zeal, and by their marked change of tone when, after the return of the royal folk to Buckingham Palace, the gates were still kept locked. What happened elsewhere I do not know; but where I was, the strength of those gates was very quickly subjected to a scientific test, and the result—which I have much pleasure in submitting to the park-keepers—showed that the gates must be made very much stronger if they are to imprison people who are resolute to get out. Far the warmest cheering heard throughout the day followed the capture of that Tel-el-Kebir gate, in the face of policemen who had a few moments before forbidden a working man to climb over it. But those who had been imprisoned had really had, at first, small reason to complain, for they had far the best and most varied view of the whole affair. Those who wished could see the *cortège* from Buckingham Palace and back, as well as the march of the soldiery to and also from the Horse Guards, and the Mall was really the only place where a tolerably large array of soldiers could be seen at one view. After continental reviews, where from fifty to a hundred thousand men are brought together, the affair was, of course, somewhat insignificant as a military display; but a view commanding the Mall at one time on the 18th was rather fine for this country. Our people, by the way, are not often favoured (?) with great military displays—when they have them they seem willing to make the most of them,—and so do our newspapers.

Of the royal *cortège* I can say little, my attention having been chiefly occupied with the soldiery and the people. Besides I was so unfortunate as not to know any of the royal family by sight. A genial and kindly-looking gentleman in a cocked hat—the Prince of Wales, people said—left a pleasant impression; and of all the ladies I saw throughout the day, none seemed more perfectly ladylike and charming than the Princess, his wife. It seems hard, by the way, that so much bowing should be expected, unless it is intended to correct the impression that princes are a stiff-necked generation: quite the contrary, I should say. A rather dull-looking Scotsman seemed from the attention given him (not only by those in the same carriage, but by the people, several of whom cheered as he passed), to be an important personage; yet, oddly enough, he was not riding inside a carriage, but at the back. I suppose he was the representative of some ancient Scottish family, doing service such as Bradwardine tells of—"the *Homagium* of the great tenants of the crown"—a sort of symbolic flunkeydom; and he may not be as dull a man as he looked. Later in the day, two well-mounted officers—the Prince of Wales and the Duke of Connaught, I think—showed great good-humour and patience under trying circumstances; for, as they rode through the crowd, they were not only loudly cheered, but some of the more ill-mannered of the "unwashed" grasped the hand of the younger with so little judgment that he seemed likely to be pulled off his horse. But he bore it all like a "prince of good fellows." The mere staring of the people was enough to have taxed any man's patience (scarce one in the crowd seemed to think that manners required that they should leave off staring when a Prince or a General was close by!), but pulling a man nearly off his horse is *par trop fort*.

A student of human nature may pass a few hours worse than in observing the ways of a British crowd. Our people are not brilliant on such occasions. The nearest approach to a joke which I heard, was the comparison of a trooper to a Dutch oven, and I suspect even this was a jest of hoar antiquity. But they are good-humoured and tolerably patient. So too are our police. Americans, who think they have more real liberty than Englishmen, may do well to note that many things which our police accepted with good-humour last Saturday, would have brought into unpleasant action the truncheons of the police of New York.

THE LIBRARIES OF BABYLONIA AND ASSYRIA.—I.

IT is now more than thirty years since Sir Henry Layard, passing through one of the doorways of the partially explored palace in the mound of Kouyunjik, guarded by sculptured fish gods, stood for the first time in the double chambers containing a large portion of the remains of the immense library collected by Assurbannipal, King of Nineveh. The floors, to a depth of a foot or more, were covered with thousands of tablets, all engraved with cuneiform writing; many in perfect condition, but the majority broken into several fragments, frequently widely separated and portions apparently sometimes missing altogether. These tablets were of various sizes, ranging from one inch square to about nine by six inches, by far the larger portion alike in shape, something similar to a pin-cushion, or dog-biscuit, but occasionally resembling a cylinder or small barrel. The lesser ones contained, perhaps, only two or three lines of characters; the larger sometimes nearly one hundred. From the manner in which they were heaped together and broken, and the fact that many have been found buried in neighbouring parts of the *débris*, it is evident that these chambers were not the original depository of the tablets, but that the library must have been placed in some upper story of the edifice of which they formed a part. Then, upon the destruction of the building, they were precipitated into the position in which the explorer found them. Some, however, owing to this violent change of site—and others because of the whole ruin at some period having been searched over, doubtless for treasure—were scattered to other parts of the mound, which consequently has to be carefully examined all over in order to restore to us the library as far as possible complete. Since that time, with but slight intermissions, this treasure-house of a forgotten past has been turned over again and again, notably in the expeditions of the late Mr. George Smith, and still the supply of its cuneiform literature is not exhausted.

Until last year this discovery remained unique; but the perseverance of the British Museum authorities and the patient labour of Mr. Rassam were then rewarded by the exhumation of what is apparently the library chamber of the temple or palace at Sippara, with all its 10,000 tablets, resting undisturbed arranged in their position on the shelves, just as placed in order by the librarian twenty-five centuries ago. In hope of both gratifying and increasing the interest awakened by this wonderful discovery, it is intended to give a short and simple account of what is known as to Babylonian and Assyrian libraries, their sites,

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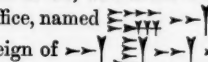
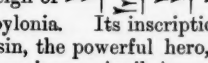
founders, librarians, and the language, writing, and subjects of their contents, embodying the most recent acquisitions to the history of the subject; but carefully adhering to the ascertained facts, and avoiding inferences, however attractive, that may still be matters of dispute.

It cannot yet be determined with certainty where was the seat of the first public library of the Accadian inhabitants of Babylonia; and even if it were, that would not inform us whether the contents of its clay tablets or books were written there for the first time, or copied from texts brought on papyri by the Accadians when they came into the country. This, however, is a question which will receive much incidental illustration when discussing the original writing materials of this people.

From what Berosus* tells us with regard to Sippara, or Pantibiblon (the town of books), the very city, one of whose libraries has just been brought to light, which, if we may judge from the first half of its contents that has arrived, was devoted to documents relating to mercantile transactions almost exclusively, having been the spot where Sisuthrus buried his literary treasures before the Deluge, it may be inferred that this was certainly one of the first towns that collected a library. It was from the site of this city, now the mound of Aboo-Habba, that Mr. Rassam sent the ancient engraved stone which he found, together with two cylinders of Nabonidus in an earthenware coffer. This stone is dated in the reign of Nabupaliddina, that is, in the ninth century B.C., and tells us that the place of its deposit is the famous temple of the sun-god E Barra, speaks of its destruction by invaders called the Sutu, mentions that Simas Sigu commenced its restoration, that the work was carried on by another monarch, but it remained for Nabupaliddina to finally destroy the Sutu and complete the temple. This King Simas Sigu is about the fortieth name in the list of early sovereigns after the Deluge discovered by Mr. Pinches, and the second monarch E Ulbargarmu occurs in the ancient list of kings, a fragment of which was found by Mr. Smith, as separated by two reigns only from Simas Sigu.

It is possible that the mound at Mugheir enshrines the oldest library of all, for here are the remains of the city of Ur (probably the Biblical Ur of the Chaldees). From this spot came the earliest known royal brick inscription, as follows:—"Urukh, King of Ur, who Bit Nannur built."† Although there are several texts from Mugheir, such as that of Dungi, son of Urukh,‡ yet, unless by means of copies made for later libraries in Assyria, we cannot be said to know much of its library. Strange to say, however, the British Museum possesses the signet cylinder of one of the librarians of Ur, who is the earliest known person holding such an office, named  (Amil-anu), who lived in the reign of  (Emuq-sin), King of Babylonia. Its inscription is given thus by Smith:—"Emuq-sin, the powerful hero, the King of Ur, King of the four regions; Amil Anu, the tablet-keeper, son of Gantu his servant." An inscription of Sin Iddinna, from Ur, relating to the excavation of a canal, and another of a monarch named Nur-vul, and also a contract tablet of his reign, are given by Smith,§ who also found a mutilated memorial tablet in the mound of Kouyunjik, which had probably been carried away from Ur by the Assyrians in some victorious campaign. It refers to "Rim-agu, the powerful hero, governor of Ur, king of Larsa, king of Sumir and Accad," a sovereign who we know, from Hammurabi's inscriptions, was defeated by him. It was Hammurabi who transferred the capital from Ur to Babylon, and, no doubt, from that time its library was surpassed by that at the latter city.

A Member of the Society of Biblical Archæology.

* A priest of the Temple of Bel, at Babylon, who wrote in Greek a history of Babylonia and Assyria derived from the archives written upon tablets preserved in libraries of Babylonia.—See Cory "Antient Fragments," and Lenormant "Essai de Commentaire des Fragments Cosmogoniques de Bérose."

† "Bit Nannur." The house of Nannur (the Moon God).

‡ Smith's "Assyrian Discoveries," 232. Some scholars pronounce the characters of Urukh's name differently as Lik Bagas.

§ Early history of Babylonia.

ANTI-CORSET PHILOSOPHY AND HISTORY.

THE letters of the Rational Dress Reformers (I should put the hyphen in one place and they in the other) provoke me to trouble you once more. I thought Dr. Chadwick's sensible and moderate answer to that highly imaginative epistle, signed F. W. Harberton, of Sept. 29, sufficient; but Mr. Leigh's, of Nov. 10, shows again that these regenerators of mankind equally despise history and personal experience and the results of daily observation; for every one now can see for himself the truth of what several other doctors wrote a dozen years ago, that in spite of all theory, "tight lacers are generally active and healthy people," and the best riders and walkers, and are evidently not the least entitled to the glory of martyrs, as is commonly assumed, and as the victims of tight boots and enormously high heels cannot conceal that they are; which are very ugly besides.

You remarked on my letter of July 21 that you knew some one who had tried tight-lacing, as recommended in several letters in the *English Mechanic* for indigestion, &c., and had found it caused a sensation of fulness in the hand. Certainly he ought not to persist in it then, nor should any one beyond the point at which internal sensations give warning to stop. One poison is no rule for another in such matters. The letters in the *English Mechanic*, and a little book full of others, selected from a now extinct periodical which I met with about ten years ago, called *Figure Training*, and others subsequently in the same magazine amply prove that. The great majority of the writers—I may say all who wrote from their own experience—said they had found the tightest lacing they could bear, especially in stays quite stiff in front, both pleasant and beneficial, and among them was a surgeon. Some, however, find it expedient to remain under contraction only a few hours in the morning, and the surgeon discarded his stays when taking strong exercise, which seems natural; but others lace tightest for riding, and ladies mostly in the evening, and some enjoy and recommend confinement in stays all night also—an old practice which used to be enforced in some families and schools. Men generally prefer belts, but not a few wrote that they found regular long and stiff stays much nicer and better for their health. Two or three said they could stand and walk much longer in them than without, and that their health relapsed whenever they gave it up. Many had begun it under some kind of compulsion, but had soon come to like it, even after severe treatment at first. As I said before, the philosophers got much the worst of it in those discussions.

My philosophy about it is that all those statements of personal experience, with their variations in detail, are worth infinitely more for practical purposes than all the talk about lungs and diaphragms and capacity of chests

(which vary a great deal naturally), nature, and anatomy, Greek women in flesh and marble, and the unquestioned bad effects of *unduly* tight-lacing, which proves nothing but itself. Such a multitude of persons of all ages and kinds cannot possibly be either mistaken or lying about the fact of their own good health, or that of their children, pupils, schoolfellows, sisters, mothers, and friends, notwithstanding, or in consequence of, their having been contracted into the smallest circumference they could bear for many years of their lives. It is very easy to be mistaken in attributing either good or bad health to a particular cause, but the fact of it cannot be doubtful. And that, with sundry medical letters such as I have alluded to, is the summary of all those letters containing any personal experience. There were one or two about ladies who had obstinately persisted, in the face of manifest warnings that they were injuring their health, and of course did so.

I remember reading years ago, in an extract from some medical newspaper, I think, that the Empress of Austria was killing herself with tight-lacing, for she happened to be ill, and was famous for the smallness of her waist—which seems to be specially cultivated there, and is even enforced on boys as well as girls, according to a gentleman who was at school in Vienna, and learnt there to enjoy being laced as tight as possible in long and stiff stays, though he was very angry at it at first, as was the case with many others of the above-mentioned writers. Well, she is now a grandmother, and we are told every year that she is still conspicuous in our hunting-fields for her riding and her figure. In one of those letters an old lady of 85 said that she used to be contracted into 15 inches when she was young, and, indeed, the compass of their own span, or from 14 to 15 inches, was often spoken of, up to about 40 years ago from very early times, as the standard to be aimed at by ladies, and frequently reached, and occasionally even 13; but more in foreign countries than this, though there was one confession of it in the book on figure-training. Of course, I am not advocating those extreme and foolish and dangerous reductions, but only using the fact that ladies lived long and in good health under them, to prove the monstrous exaggerations about the danger of waists which contain twice as much as those. You, at any rate, will see at once that a waist of 20 inches contains twice as much as one of 14, and 18 nearly half as much again as 15.

I cannot imagine what books Lady F. Harberton has been reading—or not reading—to write such amazing things as that 28 in. is the proper size for a young woman's waist, when it is a full size for a well-made young man; and, still more, that "it is only in the last twenty years that stays have been cheap enough for all classes to wear them from the age of ten years." When did maid-servants not visibly wear stays, and sometimes very tight ones? And to go down very low indeed, the "female 'prentice that Mrs. Brownrigg whipped to death and hid her in the coal-hole" (as the "Rejected Addresses" puts it), was found with scanty enough clothing on, but with leather stays next her skin, which the most fashionable ladies wore in the last century, introduced from Germany, as engines of the most powerful compression; and the same material, only thinner and stiffened with steels, has been recommended again as the nicest to wear next the skin, and keeping clean and sweet longer than anything, and only needing washing with cold water occasionally. Another old lady wrote that she was educated at a charity-school, managed by some other ladies, and that the girls all wore those stiff leather stays, "and no mercy was shown in the matter of lacing." George Cruikshank's pictures of women of all classes, exceptionally ugly and fat ones, give them wonderfully small waists; and so do the books of costumes of all nations in Europe for many centuries; and frequently the gentlemen too, whose slender waists and tight-lacing used to be the subject of satire and denunciation from very old down to very modern times, and, I suppose, of admiration none the less. If Lady Harberton is right, the higher classes ought to have perished long ago all over Europe, without waiting for this era of "cheap corsets."

It is just worth notice, on the reiterated assertions about Greek laxity, that the term "wasp-waisted," in several forms, is as old as Aristophanes. And it is certain that the Romans severely laced and shoulder-strapped their girls, and even starved them, if necessary, to make them slender and upright. *Juvencæ et graciles et sic amantur*, Terence says; and Macaulay, who had read everything, said that the Roman ladies did still worse things to preserve their figures. Whatever are the reasons for it, it is quite clear from history that corsets and tight lacing in one form or another have been the windmills of dress-reforming Quixotes for 1,000 years at least. The wind has sometimes lulled, and they have flattered themselves that they had stopped the sails; but it has always risen again and knocked over the philosophers, "clerical, medical, and general," and probably always will; so they may as well save their preaching for something more amenable, or at any rate preach more rationally than they do.

AN OBSERVER.

THE FUEL OF THE SUN.

BY W. MATTIEU WILLIAMS.

BEFORE discussing the points raised by Mr. Proctor in his original criticism, there are two in his note to my last letter that demand some explanation.

First, as regards the relative gravitation reaction of Venus, Jupiter, Saturn, and the earth upon the sun. If Mr. Proctor will turn to section 84 of "The Fuel of the Sun," he will find that I specify the "*mean* gravitation" of these planets upon the sun. I did this with express and deliberate intent, in order that I might not be understood as describing the "tide-raising action" of these planets. The difference between these is just all the difference between my figures and those of Mr. Proctor's, one varying with the cube, the other with the square of the distance of the gravitating body. Perhaps I should have been better understood had I said the "*total*," rather than the "*mean*"; but in sections 75 and 81 I had been describing the varying gravitation of Venus and the other planets on different parts of the sun, in order to show that "the nucleus of the sun, and all the different parts of the solar atmosphere, are subject to sensibly variable degrees of attraction from the same planet."

Mr. Proctor says that the disturbance of the solar action which I describe "must be akin" to tide-raising action. In the sense of common parentage it is akin, as they are both due to the reaction of gravitation upon the primary, but of themselves they are materially different. The tide-raising is a deformation, the action which I describe as "the reeling of the solar nucleus" is a motion of translation of the whole mass bodily, and this I still "maintain" varies inversely with the square of the distance of the gravitating body, and not, as Mr. Proctor's figures imply, with the cube.

Anybody who will read attentively what I have said will see *why* I make this distinction. A mere tidal deformation of a *complete* and profound fluid envelope (whether liquid or gaseous) would not produce the vortices and instirring of solar fuel which I have described. In section

68, I say "The gaseous matter would be lifted, or bulged, or undulated, as a tide-wave, and dropped again, but the solid (or more probably viscous nucleus) would be dragged bodily about with an irregular reeling motion inside this profound undulating gaseous ocean, which it would thus stir into eddies, as the stroke of a fish's tail makes eddies in a pool."

On comparing this with our own water-tides, we must remember that the depth of our ocean in relation to the whole earth is but as the thickness of the paper pasted on a 12-in. globe to the whole of that globe. I have endeavoured to show reasons for concluding that the solar nucleus within its fluid envelopes is comparable to a peach-stone within its envelope of pulp.

As regards the quotation of Carrington's figures, this is simply a blundering transposition of figures on my part, which I failed to observe until now that Mr. Proctor has detected it. The 30·86 should have been on the upper line, and the 28·36 on the lower. The error was copied mechanically in the parenthesis in my letter. All my reasoning and thinking on this part of the subject are based on the conception of greater equatorial angular velocity of the solar envelope, which I regard as produced mainly, if not entirely, by the inner reeling of the nucleus. This explanation appears to me better than any of the other theories that have hitherto been attempted, though it is not altogether free from difficulties. I prefer my own expression "reeling" to Mr. Proctor's "swaying," for reasons that I must not just now step aside to state.

Mr. Proctor says that he halted at the threshold of my argument on account of the awful stumbling-block of the "perpetual motion fallacy" which I have placed there.

I perfectly understand this difficulty, and am well aware that my theory was originally weak at this point. In 1868, when writing this chapter, I was unable to see how the retardation of stellar orbital motion or "star drift" is compensated, and booked the problem for further consideration; but I differed, and still differ diametrically from Mr. Proctor in finding any "stumbling-block" in the demand for perpetual motion. This was no bugbear to me, but the contrary. I looked to the operation of this universal principle for the solution of the problem.

In my estimation, the greatest achievement of modern physical philosophy is the demonstration that motion is absolutely, necessarily, and universally perpetual; that the total quantity of motion, or force, or matter (which are really convertible terms) in the universe, is precisely the same now as it was at the beginning, and will be the same evermore.

My conviction of the fundamental necessity of this principle convinced me that the mechanical motion thus converted into heat-motion must be somehow or somewhere restored. Broadly speaking, or briefly summarising my theory, it amounts to stating that the motion produced by gravitation or attractive force is converted into heat motion or repulsive force, nothing added, nothing taken away; simply action and reaction, equal and contrary, operating throughout the universe. How the reaction should obtain the form of bodily repulsion of masses of matter of solar magnitude I then had no idea, saw no clue to the solution of this mighty problem. Subsequently, however, it has been revealed by a series of researches, to the vast importance of which our present-moment astronomers are strangely blinded by the superstitions of transcendental molecular mathematicians.

The subject is too large for exposition here, but I have treated it in a preliminary essay on "The Philosophy of the Radiometer and its Cosmical Revelations," contributed to the "Quarterly Journal of Science," of October, 1876, and reprinted lately in "Science in Short Chapters."

I should add, however, that subsequent reflection has induced me to make a very great reduction of my estimate of the *quantity* of this atmospheric bombardment, and to regard it as a comparatively trivial factor in the maintenance of solar heat. I am, in fact, inclined to withdraw the term "bombardment" altogether. It was only used as an expression quoted from the then prevailing theory of meteoric bombardment, and does not fairly express my meaning. The term "impact," used in other parts of the book, where there is no comparison made with the meteoric "bombardment" theory, is better.

On page 378, Mr. Proctor says that there is no evidence of a lateral explosion of prominence matter with a velocity of more than 240 miles per second, that "nothing of this sort, or approaching anywhere near this, has ever been seen." I have before me the third edition of his own book, "The Sun Ruler of the Planetary System." I find there a description and pictures of the lateral explosion of a prominence 50,000 miles high flung out to a breadth exceeding its height in a few minutes. On page 80 is a picture of its appearance when first seen, and on page 81, of its lateral ejections as they were seen twenty-five minutes later. These, with the quoted description of Professor Young, and also the observations and conclusions discussed on pages 300, 301, and 302, supply abundant evidence of lateral projections hugely exceeding "the lateral expansion of cumulus clouds." Mr. Proctor evidently supposes that an enclosing case, like our bomb rockets, is necessary for the exertion of projectile results by explosion. Let him try the experiment on the very gases to which I ascribe this projection, *i.e.*, dissociated water elements, enclosed in a soap bubble. Having suffered bodily translation and overthrow by the recombination of about a quart of these gases only confined by the membrane of a bladder, I make a different estimate of their lateral projective power. In section 196, I quoted a well-known instance of the direct observation of a lateral ejection across the solar surface at the rate of 116 miles per second. This occurred in 1859, before the spectroscope came to our aid. Since that period a multitude of observations of far greater velocity have been made—too many even to name. I will, therefore, quote only one from the last report of the Astronomer Royal at the annual visitation of 1882. After referring to several observations of prominences "indicating very rapid motions of approach and recession," one example is given of a prominence examined on May 13, 1882. It "was observed to rise through a space of 30″ in less than two minutes, being at the rate of about 110 miles a second, whilst the C line showed a displacement towards the red, gradually increasing from $1\frac{1}{4}$ to 11·4 tenth mètres, corresponding to a motion of recession, increasing in two minutes from 36 to 330 miles per second."

This motion of recession seen on the limb of the sun is the lateral motion which, if I am right, must occur when the dissociated gases are flung up beyond the vaporous jacket which prevented their recombination below; and this observed acceleration is precisely what I stated should occur, as a result of progressive explosion, though at the time of writing no such acceleration had been observed.

(*Editor's Rejoinder next week.*)

The Bell Telephone Patent.—An American paper says:—"The Bell patent would, it is considered by those competent to form an opinion, be cheap at 10,000,000 dols. The consolidated telephone interests of the United States are estimated at from 100,000,000 dols. to 150,000,000 dols."

TRANSITS OF VENUS.

By Richard A. Proctor.

FOR some inscrutable reasons, any statement in which Venus, the sun, and the earth are introduced seems by many to be regarded as, of its very nature, too perplexing for any one but the astronomer even to attempt to understand. My talk in the next few paragraphs shall be about a dove, a dovecot, and a window, whereby, perhaps, some may be tempted to master the essential points of the astronominal question who would be driven out of hearing if I spoke about planets and orbits, ascending nodes and descending nodes, ingress and egress, and contacts internal and external.

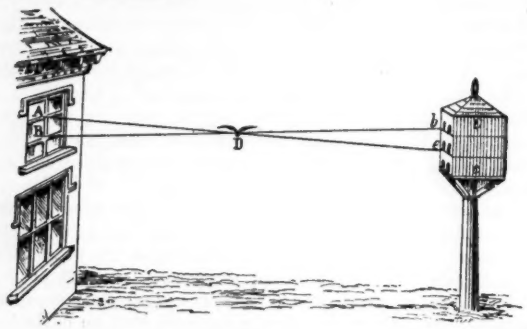


Fig. 1.

Suppose D, Fig. 1, to be a dove flying between the window, A B, and the dovecot, C *c*, and let us suppose that a person looking at the dove just over the bar, A, sees her apparently cross the cot at the level, *a*, at the foot of one row of openings, while another person, looking at the dove just over the bar B, sees her cross the cot apparently at the level, *b*, at the foot of the row of openings next above the row *a*. Now suppose that the observer does not know the distance or size of the cot, but that he does know in some way that the dove flies *just* midway between the window and the cot; then it is perfectly clear that the distance, *a b*, between the two rows of openings, is exactly the same as the distance, A B, between the two window-bars; so that our observers need only measure A B with a foot-rule to know the scale on which the dovecot is made. If A B is one foot, for instance, then *a b* is also one foot; and if the dovecot has three equal divisions, as shown at the side, then C *c* is exactly one yard in height.

Thus we have here a case where two observers, without leaving their window, can tell the size of a distant object.

And it is quite clear that wherever the dove may pass between the window and the house, the observers will be equally able to determine the size of the cot, if only they know the relative distances of the dove and dovecot.

Fig. 2.

Thus, if D *a* is twice as great as D A, as in Fig. 2, then *a b* is twice as great as A B, the length which the observers know; and if D *a* is only equal to half D A, as in Fig. 3, then *a b* is only equal to half the known length, A B. In every possible case the length of *a b* is known. Take one other case in which the proportion is not quite so simple:—Suppose that D *a* is greater than D A in the proportion of 18 to 7, as in Fig. 4; then *b a* is greater than A B in the same proportion; so that, for instance, if A B is a length of 7 in., *b a* is a length of 18 in.

Fig. 3.

We see from these simple cases how the actual size of a distant object can be learned by two observers who do not leave the room, so long only as they know the relative distances of that object and of another which comes between it and them. We need not specially concern ourselves by inquiring *how* they could determine this last point; it is enough that it might become known to them in many ways. To mention only one. Suppose the sun was shining so as to throw the shadow of the dove on a uniformly-paved court between the house and the dovecote, then it is easy to conceive how the position of the shadow on the uniform paving would enable the observers to determine (by counting rows) the relative distances of dove and dovecot.

Fig. 4.

Now, Venus comes between the earth and sun precisely as the dove in Fig. 4 comes between the window, A B, and the dovecot, *b a*. The relative distances are known exactly, and have been known for hundreds of years. They were first learned by direct observation; afterwards by the application of the laws of Kepler as interpreted and corrected by Newtonian astronomy. The distance of the earth from the sun has been found to bear to that of Venus very nearly that of 100 to 72; so that, when Venus is on a line between the earth and sun, her distances from these two bodies are as 28 to 72, or as 7 to 18.

These distances are proportioned, then, as D A to D *a* in Fig. 4; and the very same reasoning which was true in the case of dove and dovecot is true when for the dove and dovecot we substitute Venus and the sun respectively, while for the two observers looking out from a window we substitute two observers stationed at two different parts of the earth. It makes no difference in the essential principles of the problem that in one case we have to deal with inches, and in the other with thousands of miles; just as in speaking of Fig. 4 we reasoned that if A B, the distance between the eye-level of the two observers, is 7 in., then

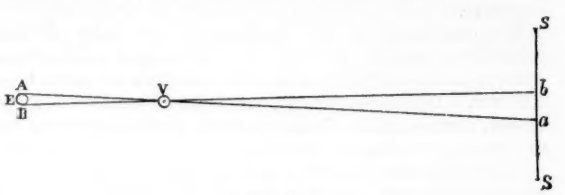


Fig. 5.

b a is 18 in., so we say that if two stations, A and B, Fig. 5, on the earth, E, are 7,000 miles apart (measuring the distance in a straight line), and an observer at A sees Venus' centre on the sun's disc at *a*, while an observer at B sees her centre on the sun's disc at *b*, then *b a* (measured in a straight line, and regarded as part of the upright diameter of the sun) is equal to 18,000 miles. So that if two observers, so placed, could observe Venus at the same instant, and note exactly where her centre seemed to fall, then since

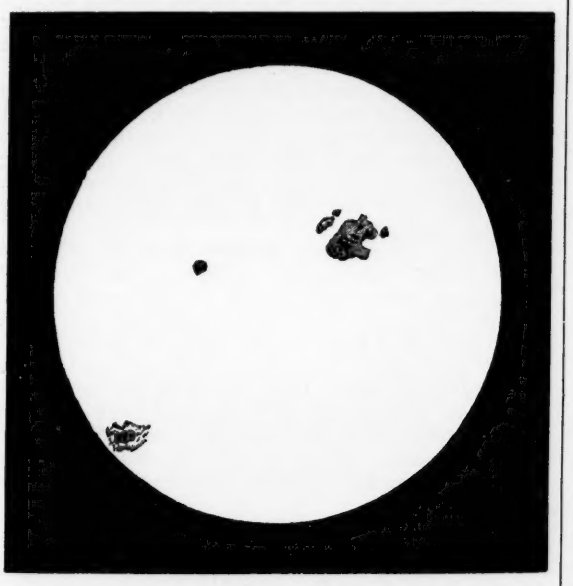
they would thus have learned what proportion $b\,a$ is of the whole diameter S S′ of the sun, they would know how many miles there are in that diameter. Suppose, for instance, they found, on comparing notes, that $b\,a$ is about the forty-seventh part of the whole diameter, they would know that the diameter of the sun is about 47 times 18,000 miles, or about 846,000 miles.

Now, finding the real size of an object like the sun, whose apparent size we can so easily measure, is the same thing as finding his distance. Any one can tell how many times its own diameter the sun is removed from us. Take a circular disc an inch in diameter—a halfpenny, for instance—and see how far away it must be placed to exactly hide the sun. The distance will be found to be rather more than 107 in., so that the sun, like the halfpenny which hides his face, must be rather more than 107 times his own diameter from us. But 107 times 846,000 miles amounts to 90,522,000 miles. This, therefore, if the imagined observations were correctly made, would be the sun's distance.

(*To be continued.*)

THE GREAT SUN-SPOT.

WE have endeavoured (but, as we write, we are by no means sure we are in time) to give a telescopic view of the aspect of the sun with the great spot on it, which has been visible to the naked eye during the last



week, whenever the sun's disc has been somewhat dimmed by fog or mist. The actual area of disturbance is almost as large as any single area ever recorded; though no actual umbra of any very extraordinary size is now visible on the sun's face. As will be seen from our picture, the spot—regarding as one the whole penumbral region—has four large umbræ and many smaller ones. We show the spot as it appeared on Monday, seen under very unfavourable atmospheric conditions, our rough sketch being only just finished before the sky clouded over, and the opportunity for further observation was lost. The evidence of disturbance around the spot region was marked. But the faculæ around the triple spot which has recently come into view near the eastern edge are even more conspicuous than those around the great region of disturbance, though, within the large penumbral region of disturbance, facular streaks of great splendour can be seen.

We are inclined to believe that the great spot is a phenomenon by no means so independent of the great comet as some of the daily papers have confidently asserted it to be. Professor Kirkwood's theory of the association of a great solar disturbance with meteoric matter following in the train of the great comet of 1843 will here occur to many readers. We shall touch on this later.

THE AURORA.

ON Friday evening, at about the time of sunset, if not earlier, a magnificent aurora was visible. When it began, the sky was partly clouded, and the appearance presented was as though behind the darker cumulus clouds there was a bank of cirrus clouds still illuminated by the setting sun. But the position of the region of greatest splendour, in the magnetic meridian, or some seventeen degrees west of north, indicated the real character of the phenomenon. As the clouds broke up and thinned they presented a singular appearance, looking almost green by contrast with the crimson red of the auroral clouds. When they had entirely cleared away, the crimson effulgence remained, though by this time it seemed somewhat less intense; it reached in streamers to a great distance from the arch of greatest splendour, and for a long time the crimson light could be seen extending to, and even beyond, the zenith. The aurora remained, with varying brilliancy, till near 5 a.m. Saturday.

At about five minutes past six a singular phenomenon was observed. A cloud of whitish light, shaped like torpedo, passed from the south-eastern to the north-western horizon (some accounts say from east to west, but the true direction was from a little east of south-east to a little north of north-west). It was of nearly uniform brightness. Its length was nearly ninety degrees. (One observer says that its size, compared with that of the moon (which was shining brightly at the time), was as a herring compared with a sixpenny-piece; but as he does not name the price of his illustrative herring, the illustration is not so satisfactory as could be wished: does he mean a penny herring, or one of those which may be obtained, we understand, at two a penny?) It passed across the heavens in about two minutes. It is described as a cometary body; but as it moved almost exactly at right-angles to the magnetic meridian, there can be very little doubt it was an electrical phenomenon. The appearance is akin to that sometimes seen in high latitudes, as the auroral streamers vary in position, aggregation, and length, seeming to throw folds of brightness, shaped like the folds of a curtain, athwart the auroral arch.

An electrical storm of great violence prevailed from

Friday till Sunday. Strong earth currents disturbed the action of the telegraph and telephone lines. In Canada and the United States, as far west as Utah, the electrical disturbance was felt. Electricians say that the disturbance was unlike any heretofore known, acting on the wires in strong waves, which produced constant changes in the polarity of the current. A magnificent aurora was visible throughout Canada and the United States.

The phenomena were akin in many respects to those described in the editor's treatise on The Sun, as accompanying and following the great solar disturbance of September, 1859.

SATURN'S RINGS.

MR. LYNN explains that his remark in the *Athenæum* referred, not, as I supposed, to the passage in which I thanked Captain Noble for calling attention to this subject in KNOWLEDGE, but to my remark in KNOWLEDGE for Oct. 13 to the effect that a writer in the *Athenæum* had "followed Captain Noble's lead"—a remark founded, as he correctly supposes, upon an article in the *Athenæum* for Oct. 7th, quoting a letter of Mr. Lynn's as its authority. He adds: "Perhaps you will kindly explain how ascribing the lead to Captain Noble, whose letter, as Mr. Maunder informed you, was written after mine, differs from ascribing the first notice to him." Since I referred to the writer in the *Athenæum*, not to Mr. Lynn, as following Captain Noble's lead, there is nothing, I apprehend, to explain.

I may take this opportunity of noting that I attach the least possible importance to the question, Who first saw with the telescope any feature which the telescope was bound, earlier or later, to reveal. There is something to my mind altogether inconsistent with the dignity of science, in the childish logogriphs under which men really great in science concealed their discoveries, lest they should lose claim to the distinction of having been the first to see something. There are many, however, who speak of a first view of some astronomical object as if it deserved no less credit than the discovery of Neptune or the labours of the Herschels among stars and nebulæ. R. A. PROCTOR.

HAS THE MOON AN ATMOSPHERE?

BY W. MATTIEU WILLIAMS.

THE letter of Mr. B. J. Hopkins, p. 379, reminded me of Mr. Ranyard's paper on this subject, which I had marked *to be* read when it appeared.

It appears that he and others investigating this subject have omitted the consideration of a condition which I pointed out in Chapter XV. of "The Fuel of the Sun," as follows:—"In the determination of the pressure of the atmosphere upon the earth we take our barometers to the sea-level, *i.e.*, the lowest portion of the earth's general surface. We must in like manner take our imaginary barometers to the lowest *general* surface of the moon to obtain this calculated column of mercury of six-tenths of an inch (estimated on the assumption that the moon has its gravitation-equivalent of general atmospheric matter). From the excessive irregularity of the lunar surface it would be very difficult to define clearly where this lowest *general* surface is. It must be at the bottom of the average craters and valleys of the lunar surface, probably about the mean level of the *Oceanus Procellarum*, and the other dark regions called the 'Maria' by selenographists.

"The observations of occultations are generally stated to indicate no atmosphere, though some doubts as to the absolute truth of this have been expressed. Now, the edge of the lunar disc, by which the boundary of the moon's diameter is measured, and which determines the beginning and end of an occultation, is formed by the summits of the lunar peaks and ranges, levelled by the effect of perspective; for we look upon them horizontally, as though from their own summit level. The only portion of the lunar atmosphere remaining for the purposes of horizontal refraction, visible from the earth, must be that which rises above these lofty summits."

The passage that confirms my supposition of the omission of this consideration is that commencing Mr. Ranyard's last paragraph, on page 215, where he says—"It will be seen that the light which enters the slit close to the moon's limb must, if there be a solar atmosphere, have passed through the densest portions of it."

We must remember that in comparing the rarefaction of the lunar atmosphere on the mountains of the moon with that on our terrestrial mountains, we have an ocean of water filling the deepest depressions of the earth, and our atmosphere starts from the surface level of this ocean, while in the moon the corresponding depressions would operate as atmospheric basins, into which an excessive proportion of the general atmosphere would be compressed and concentrated.

The difference between the results obtained by M. Thollon and M. Trépied may, I think, be explained by the possibility of the radial slit of M. Trépied catching the rays coming through a notch or depression between the lunar mountains, while the tangential slit of M. Thollon swept across the summits and ridges.

If I am right in this, the atmospheric lines seen in the first case should be displayed of full length; in the second only as fragments, occurring where the length of the slit visually crossed a notch caused by a lunar valley running transversely to the line of the visible lunar horizon or limb. This result would have the puzzling and contradictory character described.

[We may conveniently consider what the difference would be in a valley, say two miles below the mean level (though such valleys must be too few and small to form any appreciable part of the moon's limb), and at a height of two miles above that level (though parts at that height can in like manner form but a very small part of the moon's apparent edge). On our earth the atmosphere doubles in pressure for each three-and-a-half miles of descent; on the moon, where gravity is one-sixth, for each twenty-one miles. Hence, if $\rho : 1$ is the ratio between the densities at lower and higher of these levels, we have the relation:—

$$\log. \rho = \frac{4}{21} \log. 2$$

(the logarithms being hyperbolic.)

Now, Neperian log. 2 = 0·6931472

4

21)2·7725888

1320280 = log. 1·14.

Hence the variation of density to which Mr. Williams attaches so much importance is in the ratio of 114 to 100, or (very nearly) of 8 to 7. All that we know of the conformation of the moon's surface, however, assures us that nothing like a difference of 4 miles could exist between any appreciable parts of the moon's edge. A difference of 21 miles in level would be required to produce a ratio of

2 to 1 between the densities, where the lines of vision touch the moon's edge. But except in occultations of stars we cannot really use such tangent visual lines, though we may seem to do so.—Ed.]

BUTTERFLIES AND MOTHS.

By W. J. H. Clark.

THERE are many other methods employed in pupa hunting besides digging, and at this period of the year, all will prove more or less productive, and though a very large proportion of the captures will probably consist of very common species, yet now and then a rarity will be obtained which will amply repay all the trouble which may have been taken with the others.

Among the best localities for pupa hunting, besides those noticed in last paper, we may mention woods where clearings have been made, open heaths and commons, coasts, sand-hills, fields, &c.

An open light soil will be the most productive, while hard, wet clay will yield nothing for our pains. Dead foliage lying on the ground will also give good results if very carefully examined and raked over, but it must be well shaken about for any pupæ which might have attached themselves to the leaves. The best way is to take a large sack and fill it with leaves, and, after having brought it home, to subject them to a thorough examination at leisure.

Next, the leaves of trees must be examined for the pupæ of those moths which spin the leaves together when undergoing their change from the larval to the pupal state. When a leaf is found rolled up, it may be nearly always suspected to contain a pupa of some kind or other, and should not be unfolded, but brought home intact on spec. However, if we wish to make perfectly sure as to whether there is any inhabitant or not, hold it up to the light, when the outline of the contained pupa will be clearly seen through the semi-transparent leaf. A large number of the *Tortrices* and various others will be obtained in this way.

In the cracks and other irregularities on the bark of trees will often be found the chrysalides of several of the *Bombyces* and others, and the tree should be thoroughly searched all round. If anything be found, do not attempt to detach it by force, but cut away the piece of bark or wood to which it is joined as well. If there be any pieces of loose bark on the tree, endeavour to tear them off, as very often large numbers of pupæ will be found sheltering underneath.

Some larvæ burrow right into the wood itself, and for these a very particular search must be made, as their haunts are not so easily found out. We have all seen the large tunnels made by the Goat moth (*Cossus ligniperda*) in our apple-trees, and other smaller tunnels constructed by various *Sesiadæ*, &c., and the question is how to get at the inhabitants. The best way is to cut off the branch or branches and take them home, and there wait patiently until the imago emerges.

All small bushes should be carefully examined, both on the branches and among the leaves; the roots, &c., should also be looked over, as several species of larvæ go amidst the network of shoots for a resting-place.

The grass and other low plants should be thoroughly searched, and all rubbish of any kind turned over and examined; sheltered walls, underneath the ledges of walls and outbuildings, old fences, &c., will also yield good results; in fact, there is no outdoor situation which does not often form a home for some larva or other.

The pupæ of *Hydrocampidæ* and other water-inhabiting species can only be obtained by dragging among the aquatic plants with a small meshed water-net.

When we have obtained our pupæ, the great thing is to keep them so that as large a number as possible may develope into the perfect insect. This requires careful treatment, which, for different species, must be of different natures.

In all cases the source from which the pupa was obtained must guide us in keeping it, and we should always endeavour to follow nature as nearly as possible if we wish to succeed in anything connected with the rearing of either larvæ or pupæ.

Pupæ which have been obtained from under the surface of the earth must be treated as follows:—They should be kept in an earthenware pan containing some light, friable soil, which is not too dry, and a layer of moss put on top, which must occasionally be sprinkled with water in order to keep up the moisture of the soil; be very careful not to make the soil *wet*, but only *naturally moist*, as if it be kept too damp, most of the pupæ will be lost from mould, or will rot away.

For those chrysalides which have been obtained from twigs or walls and places exposed to the air, we must make a frame consisting of four pieces of wood joined together at right angles thus □, with a piece of muslin or gauze stretched over them, so as to form a sort of tray, on which the pupæ are to be laid, and hung up in an outhouse, or where a current of fresh air is continually passing, as this prevents the ravages of disease and mould.

The pupæ captured by water-dragging must be kept in jars or globes, filled with water, and covered over with muslin or gauze.

Some one of the above-mentioned methods of rearing will do for nearly every species which can be found in this country, but exotic and other foreign pupæ require special treatment, varying according to the climate and surroundings of the country in which they are found.

Substance for Casts.—A prize of £500 was offered in 1877 by the German Government for the invention of a material as suitable as gypsum for taking casts of works of art, and yet capable of repeated cleaning. Forty-one candidates have sent in specimen casts, but none have been judged so absolutely satisfactory as to gain the prize.—*Mechanical World.*

In Lowell, Mass., there is a telephone for every 62 inhabitants, although the population numbers some 20,000 mill-hands. In Portland, Maine, there is a telephone for every 50 inhabitants. The telephones do as much business as the telegraph lines between those cities, and yet the telegraph company does 50 per cent. more business than it did two years ago.

Wire Fencing in Thunderstorms.—During a thunderstorm recently, five sheep were killed on the farm of Cotland, Tinwald parish, in Scotland. In one field there was a wire fence for a distance of 300 yards. The current had travelled along this, breaking the wooden posts at various distances, and at the end of the fence two sheep were struck and killed. In an adjoining field, separated from the other by a farm road, the fence was a stone wall, with a single wire on the top. This wire was broken, and touched the ground about forty yards from the road. A number of sheep were crouching near the broken wire, and three of them were killed.

XUM

Letters to the Editor.

[The Editor does not hold himself responsible for the opinions of his correspondents. He cannot undertake to return manuscripts or to correspond with their writers. All communications should be as short as possible, consistently with full and clear statements of the writer's meaning.]

All Editorial communications should be addressed to the Editor of KNOWLEDGE: *all Business communications to the Publishers, at the Office, 74, Great Queen-street, W.C.*

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**** All letters to the Editor will be Numbered. For convenience of reference, correspondents, when referring to any letter, will oblige by mentioning its number and the page on which it appears.*

"In knowledge, that man only is to be contemned and despised who is not in a state of transition. . . . . Nor is there anything more adverse to accuracy than fixity of opinion."—*Faraday.*

"Show me a man who makes no mistakes, and I will show you a man who has done nothing."—*Liebig.*

SELF-INOCULATION OF HYDROPHOBIA.

[634]—In asking the question, "Can a dog inoculate itself with hydrophobia?" "H. A." evidently overlooks the fact that the affection is not a *local*, but a *general* disease, and that the development of a specific virus in the region of the mouth, capable of propagating the disorder, is only a local symptom. Therefore, none but an animal already hydrophobic, manifestly or latently, could communicate the malady to *any* creature; though at how early a stage this may be possible is as yet uncertain. The fever known as small-pox is communicable from one person to another by inoculation of the matter contained in the pustules; but a man would not give himself small-pox by taking the secretion from a pustule on his arm and putting it into his leg, because he has the fever already throughout what is vaguely termed the "system," and the pustules are only one indication of its presence. But he might infect his left hand with itch from his right, a proceeding no more concerning the constitution than tossing a ball from one hand to the other.

"Can a venomous snake poison itself by its own bite?" would be a question of greater pathological interest, since there is much conflicting evidence on the point.

29, Woodford-road, Watford. ARTHUR STRADLING, C.M.Z.S., &c.

ENGLISH SNAKE.

[635]—In reply to the query of "C. E. S." (610), I beg to inform him that there is an English snake, termed the *Coronella Lævis*, differing both from the common ringed snake and the adder or viper. A specimen was brought to my father as long ago as the year 1858, and is still in possession of the family. I believe it was not recognised or described by naturalists until three or four years after that date, when it was thought to be a new species. I have myself caught several specimens in the neighbourhood of Wareham, Dorset. It is smaller than the common snake, of a brownish colour, has no particular markings, and can be readily distinguished from the adder by the absence of the black lozenge-shaped pattern all down the back.

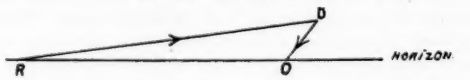
The scales are not imbricated, and I believe (I have not the specimen at hand), they are wanting in the keel or ridge which is to be seen running longitudinally along the middle of each scale of the other species. In these respects it might be mistaken for the slow worm, but it is a true snake, having extensile jaws and a row of palatine teeth. It has no poison fangs, and is perfectly harmless, though it bites angrily at the finger or any other object presented to it. R. LEWIS WILLCOX.

COLD BATH AT NIGHT.

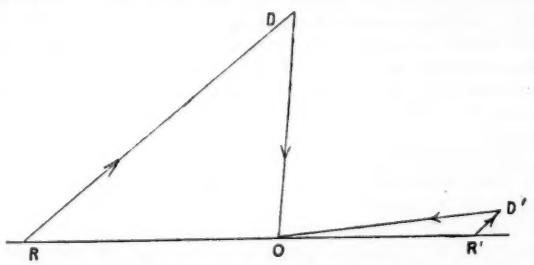
[636]—In reply to "A. E. Oram," No. 605, p. 364, perhaps you will allow me to state the conclusions I have arrived at after many years' experience of taking baths both in summer and winter. To take a cold bath at night, when the body is more or less exhausted with the labours of the day, would do no good whatever, and would be highly dangerous to weak persons. It is quite necessary that the body be warm and free from exhaustion at the time of plunging into cold water, and these conditions are most generally combined at the time of leaving the bed in the morning, but seldom at night, and even if they were, a cold bath on going to bed would not have the effect that "I. S.," No. 583, p. 314, thinks it would, viz., to induce sleep. I, too, suffer at times from sleeplessness, and on two or three occasions have jumped out of bed and taken a cold bath in sheer desperation; but the effect has been to drive away all chance of sleep for the remainder of the night. On the other hand, a hot bath at night is both healthful and soothing. It should be taken immediately before going to bed, at a temperature of from 95 to 98 degrees, and it will generally induce sleep whether after a day's physical labour or not. A hot bath frequently at night and cold bath every morning summer and winter, would be highly beneficial, but I have found it best in winter to make the cold bath a mere dip, as a prolonged immersion takes too much heat from the body.

G. HANN.

SINGULAR RAINBOW.



[637]—Referring to primary bow only, and taking deviation through a rain-drop =40°, the above figure will represent the case of sun's altitude =5° Sun's rays reflected at R *behind* observer, deviated 40° by drop at D to observer O. I cannot see how when sun is *low* (lower than 40°), a bow can be seen by rays reflected *in front* of observer. On the other hand when the sun is between 40° and 50°, say 45°, an observer on a bridge may see two sets of reflected bows, one by reflexion in front, the other by reflexion behind, thus:—



Rays reflected at R behind observer form a high bow at D. Rays reflected at R′ in front of observer form a low bow at D′. In this case the usual direct bow is not formed. If I am correct, it is curious that the phenomenon is not more often noticed.

A. LE SUEUR.

IRON PYRITES.

[638]—Can any of your readers inform me if it is possible to melt up and make any use of the nodules of iron pyrites (popularly called thunderbolts) which so thickly strew the beach at Eastbourne, St. Margaret's, and other places on our southern coast? If they are good soluble metal, many tons of valuable material seem to be wasted. I shall be glad to know if there is anything in their chemical composition which prevents their being treated as useful metal, either melted and cast alone, or mixed with other metal.

D. & M.

BREWING AND MALTING.

[639]—I have been consulted by the head of a family in California, U.S., as to the best method of brewing and malting, and the most suitable practical works on the subject. The object is simply to supply home wants; not sale. If you could or would give me any information on these points I should be much obliged. It appears that almost all drinks in the State are largely adulterated.

CALIFORNIA.

After Dryden.

"Three Pens for three essential virtues famed,
The *Pickwick*, *Owl*, and *Waverley* were named,
The first in flexibility surpassed,
In ease the next, in elegance the last.
These points united with attractions new,
Have yielded other boons, the *Phaeton* and *Hindoo*."

Sample Box, with all the kinds, 1s. 1d. by Post.

"Let those write now who never wrote before;
And those who always wrote now write the more."—*Oban Times.*

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Answers to Correspondents.

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E. S. THORNE. I quite agree with you. No man who has ever walked past that Kew wall should fail to do all that in him lies to get it replaced by a railing. I do not live in a house overlooking the grounds, but if a subscription is opened to raise the necessary sum, I will gladly put down my name for £10. But Sir J. Hooker would infallibly resign if Government agreed to such a change, and what would old England do then, poor thing?—F. S. L. The question related to a garden-walk, and though a circle is, as you say, one of the limiting forms of the ellipse, a circular walk would not therefore be regarded as an elliptical one.—W. H. TAYLOR. Thanks; but medals are apter rewards for prize pigs than for men.—J. SPIERS. I should only be too glad to have an excuse for visiting old Ayr, where I passed a very happy half-year.—POOR STUDENT should note what sort of work he wants the spectroscope to do. For some very simple work, a slit and a prism, with a blackened tube or so, would serve very well; for other work something more elaborate must be made.—W. S. PAVITT. That light theory of comet's tails is not only foiled by multiple tails, but by curved tails, thwart streaks, and other phenomena. But it will not do anyhow. It has been tried many times, and never would fit a single case.—GRADATIM. I write away from my books (lecturing at Newcastle), but you will find in De Morgan's "Budget of Paradoxes," $\sqrt{2}$ to 110 digits. There are two digits which appear only 8 times, and digit 7 appears no less than 18 times. But you can try this experiment: Take out a list of digits at random, by opening a book of logarithms and bringing down a pencil point at random in the open page, marking down in your list the digit nearest to the point marked. You will find nearly always among the digits thus taken out, one or two which get the lead in numbers and keep it, one or two which fall behind and keep behind. It is because there are so many digits that the chances are one or other will be, as it were, lucky in the drawing, and one or other unlucky. Of course, the mathematical question is dealt with by comparing, for n trials, the sum of all the co-efficients in the expansion of

$$(x_0 + x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9)^n$$

in which the power of *any* one of the terms falls short of $n \div 10$ in a given degree *at least*, with the sum of all the remaining co-efficients.—W. S. BRADLEY. About the comet, shortly; but we (students of science generally, I mean, not "we" editorially) know much less about comets than we should like to. On the other point—the bet was an idle one; but he might have safely wagered his £50 that no one could convince *him* the moon was not "perfectly stationary, and never moves from place to place."—"TARANAKI." The evolute of a circle is a point—the circle's centre. The evolute of a straight line is either of the points at infinity in direction perpendicular to the line.—H. DENNYS. I must ask "Mephisto."—AN INVALID. We should certainly recommend you to have a fire; but we are not medical.—INQUISITIVE. I forget what particular defeat of the Spaniards is referred to by Browning in the poem you mention.—K. L. MCGRATH. Let us consider the point logically, if your wrath, which really seems blinding, will permit you. You say, "Kerdic was a pirate," and "Rollo was a pirate;" you count me out your ten murderers and eleven imbeciles, cite Richard Sans-peur and William the Conqueror himself as of illegitimate birth, and William of Luneberg, George III., and a third, as subject during parts of their lives to attacks of mental aberration. Then you ask me if I "dare to deny that the parable related to them." I dare say not, if you dare say so much. But either you are right in all your statements, or you are not. If you are *not* right, you should hold your peace; and if you *are* right, I cannot be far wrong. As to your strongly-expressed wrath, I can only say, God keep you in your present mind, for you treat your friends ill. "Call you *that* backing of your friends?" If so, I would rather not be one of them.—F. FOOT. It is quite true that the obliquity of the Ecliptic has changed since the days of the first astronomers. This is due to the disturbing actions of the planets by which the path of the earth has been changed; in other words, the position of the Ecliptic itself has been changed, not the axial pose of the earth in space.—D. MAXWELL. Is not that rather what one would expect, than the reverse? The result in Tyndall's experiment is what one would not expect; but where the close packing of the particles is done away with, as in your experiment, one would expect its effects to be corrected too.—S. D. I use Chauvenet's "Astronomy" for the purposes you name.—S. STANDRING. Oh! give us a rest: or write about matters less difficult. Metaphysics is not in our line. Besides, you spell so erratically, it is hard to know what you mean.—M. D. Uranus goes the right way round; it presumably rotates the same way as its satellites, but its rotation has never been properly observed.—G. T. RYVES. I quite agree with you about the comet; it is very difficult to get engravers to attend to such points closely. It is now not likely that the comet will return anything like so soon as had been thought. The poem is capital, all but the too complimentary adjectives applied to Mr. Proctor.—R. J. H. Those figures on p. 344? Which figures? If you refer to my figures about the Egyptian signalling, they are nearly correct. The depression for a mile is rather less than 6 in. when correction is made for refraction. Sidereal time is measured from the time when the first point of Aries crosses the meridian. Now, on March 21, if sun at first point of Aries at noon, the sidereal time at *apparent* noon will be 0 h. 0 m. 0s.; but at *mean* noon, which is six or seven minutes earlier, sidereal time is some six or seven minutes earlier too, or 23 h. 53 m. or 54 m.—DEBATE. Do not know where you can find any account of the failure of justice through the incorrect findings of juries.—E. GERRISH. The quotation will be found at the end of my "Universe of Stars."—J. wants the solution of the following problem: To describe three circles in a triangle, each circle touching two sides of the triangle and the other two circles.—A. SHEPHERD. The reflected bow in such pictures is manifestly wrong, but if you draw the angles correctly you will find your smaller reflected bow could not be given.—A. C. It is of little use to look at Neptune with a 3-in. telescope, though you can see it. The "Nautical Almanack" gives the place, which you can mark down in any good map.—R. C. TAYLOR. A sovereign contains 113·001 grains of gold and 10·273 grains of alloy.—E. R. COWLEY. Those questions, to be properly dealt with, would require all the space in a volume of KNOWLEDGE, and much very profound reasoning and calculation.—W. B. PHILLIPS. Jupiter has been in Gemini lately. Certainly Venus visible as an evening star, and rather a bright one.—G. GARRATT. Do not know where the results of the observations of Mars in 1877 have been collected.—C. W. G. Thanks.—E. GSCHWIND. A very noteworthy observation: we should be glad to learn whether any other noticed the passage of a meteor apparently from tail to head of comet at 5.17 on the morning of Nov. 8.—F. H. M. wishes to know whether trapped animals are unfit for food, owing to blood-poisoning, resulting from their death agonies.—NIL DESPERANDUM. Want of practice prevents some from winking without blinking. Try again; only not when ladies are passing.—J. F. You should get Mr. Pearson's book on the tides.—UNIT. Consider the equation $v^2 = 2gh$, and I think you will see why kinetic energy $= \frac{1}{2} mv^2$.—X. Y. Yes; we do think it impertinent curiosity to inquire into a man's religious belief, while we consider it only just and proper to inquire how he discharges duties for which he is paid (by you and me, among the rest). If men thus paid are hardened against deserved censure, they must be punished in any way by which they can be reached—by ridicule, if that serves. As for courtesy, a man of sense who had found reason fail, would as soon think of extending courtesy to—well, to any other wilful wrongdoer.

Our Whist Column.

BY "FIVE OF CLUBS."

PLAY FOURTH HAND.

THE fourth player's duty is usually but to win the trick if he can, and as cheaply as he can. The exceptions usually belong to the cases in which the general conduct of the hand involves considerations overruling such rules of detail as we are for the present considering. Thus, the player fourth in hand may be unable to win a trick except by ruffing, and ruffing may mean giving up all chance of commanding the run of trumps and bringing in a long suit: in that case, he would pass the trick. Or it may happen that the card of the suit with which he could alone take the trick would obviously be likely to serve as a re-entering card, after trumps were exhausted: in such a case, if the chances were clearly in favour of that power of re-entry being obtainable in no other way, fourth hand should pass the trick. The consideration of such points belongs to a later stage of our discussion of Whist principles. We may simply note here that in all such cases a good general rule to bear in mind is that a certain trick ought not to be passed, unless there is a great probability of making two by so doing, always remembering, however, that if the game can only be

saved by making the two, the trick should always be passed, while, of course, if one trick saves or makes the game, it should be made.

A case often arises (it is often spoken of as if fourth hand alone were concerned, but it applies to second hand equally) where it is questionable whether a trick should be passed or taken. King is led in a suit of which you hold Ace, Knave, and others. Here many pass the trick, because, if the suit is continued, as it usually is, they hold the tenace, and, apart from ruffing, make two tricks instead of one in the suit. Holding up the Ace second hand in such cases, though not generally good, is occasionally advisable. But it is seldom safe to pass the trick when you hold Ace, Knave, and another fourth in hand. There is a considerable chance that either your partner or your right hand adversary may have held originally but one of the suit, and, if so, either would trump. Your partner would trump, if he could, because he would believe the Ace to be with third hand. Third hand would, of course, trump if he could—a small card having been led. Where you hold up the Ace second hand, you have a much better chance, for you run no risk of being trumped by your partner. Clay adds to these considerations, that you give up for one round, at least, the advantage of getting the lead; that, however, may be an advantage, or the reverse, according to the nature of your hand. He adds, "the leader, either from suspecting your tenace, or because he has another strong suit to show his partner, changes his lead, and when it is next led it is probably by your right-hand adversary, who leads through your tenace, instead of to it." These considerations are less important, however, than the others; for usually no tenace would be suspected, covering with ace being the usual custom, and it very seldom happens that a player finds it well to show a second suit to his partner. The fall of the cards in the first suit may, of course, lead him to do so; but ordinarily he will keep to one suit. The case is rather different, when his partner has already shown a suit. For then, the possibility of a held-up tenace (however slight), may lead him to prefer returning his partner's suit—who can afterwards lead the Ace if he has it, and then up to the Queen.

That playing a small card in such a case gives your partner a wrong idea of the contents of your hand is a valid argument against passing the trick, unless the indications are such that you are justified in attaching less importance to informing him than to strengthening your own position. If you are strong in trumps, there is a further reasen for disregarding this point. For should the leader be led to suspect that a tenace is held up, he will be apt to lead trumps, which can hardly fail to suit your hand.

Cases of two kinds have specially to be noticed in playing fourth in hand,—first, those in which it is necessary to take a trick already won by partner; secondly, those in which it is necessary to pass a trick won by the adversaries. We are not going to consider all cases of the kind, for many depend on the previous fall of cards, and the strategy of the hand as a whole. But two simple general cases of either sort, must be considered here.

(*To be continued.*)

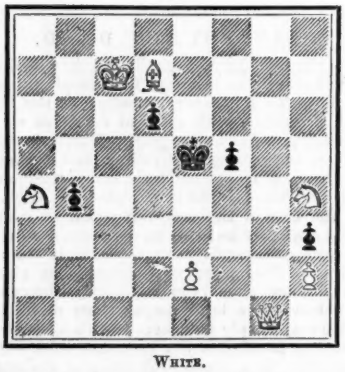
Our Chess Column.

By Mephisto.

PROBLEM No. 60.

By John Simpson, Edinburgh.

Black.



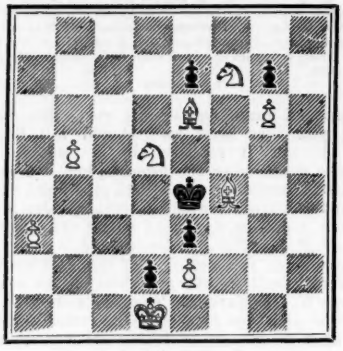
White.

White to play and mate in three moves.

PROBLEM No. 61.

By Leonard P. Rees.

Black.



White.

White to play and mate in three moves.

SOLUTION.

Problem No. 59, by Herbert Jacobs, p. 396

1. B to Kt2 — 1. Anything.
2. Kt to B6 mate.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Problems received with thanks from John O'Keeffe, Francis J. Drake; will be examined.

Brimstone.—In questions of that kind it is usual to give name and address, besides the *nom de plume*.

G. W. Barrow.—We agree with you that the idea in Problem 54 was far better worked out than in Eichstadt's composition; there are several unnecessary pieces on the Queen's side in the latter problem.

Correct solution of Problem 59 received from F. W. Cooper, E. A. F., T. Steele, Sheldon, (Old Meldrum, wrongly addressed to Chief Editor.)

Reprint Problem.—Berrow, S. Jordan, J. K. Milne, S. Bassau, Lello, W. J. Reynolds, G. W., John Watson, G. H. Bonner, John O'Keeffe.

NOTICES.

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